

CLAIMS

What is claimed:

1. A method of analyzing spectral data to measure a structure in a layer of tissue comprising:

providing a light collection system that collects fluorescent and reflected light from the tissue at a plurality of wavelengths and detects the collected light;

5 forming a fluorescence representation and a scattered light representation as a function of wavelength from the detected light; and

determining a characteristic of the tissue layer with the fluorescence representation and the scattered light representation.

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2. The method of Claim 1 further comprising using the fluorescence representation to determine one or more components of the tissue.

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3. The method of Claim 1 further comprising using the scattered light representation to determine a size of a structure within the tissue layer.

4. The method of Claim 1 further comprising measuring a periodic component of the detected light to provide the scattered light representation.

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5. The method of Claim 1 further comprising analyzing a diffuse reflectance spectrum and a light scattering spectrum.

6. The method of Claim 1 further comprising calibrating with a reflectance standard and a fluorescence standard.

7. The method of Claim 1 further comprising generating a lookup table with different sizes of scatterers.

8. The method of Claim 1 further comprising correcting the fluorescence spectrum to obtain an intrinsic fluorescence spectrum.

5 9. The method of Claim 5 further comprising transforming the light scattering spectrum and removing spectral components to determine size distribution of a tissue component.

10. The method of Claim 1 further comprising performing discriminative analysis to diagnose the tissue.

10 11. The method of Claim 1 further comprising separating a plurality of scattering coefficient values into a plurality of different regions.

12. An apparatus for optically measuring tissue comprising:
a radiation source that illuminates a region of interest in tissue to be measured with incident radiation;
an optical system that collects scattered and fluorescent light from the tissue at a plurality of wavelengths;
a detector system that senses the collected light and provides fluorescence data and scattered light data as a function of wavelength;
and
20 a data processor that determines a characteristic of the region of interest with the fluorescence data and the scattered light data.

25 13. The apparatus of Claim 12 further comprising a broadband light source that generates light in the range of 330-700 nm.

14. The apparatus of Claim 12 further comprising a fiber optic probe that couples the source to the tissue.

15. The apparatus of Claim 12 wherein the probe is insertable in an endoscope.

16. The apparatus of Claim 12 further comprising a fast excitation-emission matrix instrument.

17. A method for analyzing tissue spectra comprising:
acquiring fluorescence spectra;
acquiring a reflectance spectra;
processing the fluorescence spectra and reflectance spectra to provide an intrinsic fluorescence spectrum, a diffuse reflectance spectrum and a light scattering spectrum; and
determining a biophysical tissue characteristic from the intrinsic fluorescence spectrum, the diffuse reflectance spectrum and light scattering spectrum.

18. A computer readable medium having stored therein a set of instructions for causing a processing unit to execute the steps of the method of Claim 17.

19. The method of Claim 17 further comprising determining a size of a structure within the tissue layer.

20. The method of Claim 19 wherein the structure is the nuclei of epithelial cells in the tissue.

21. The method of Claim 17 further comprising measuring a periodic component of the detected reflectance spectrum.

5 22. The method of Claim 17 further comprising calibrating with a reflectance standard and a fluorescence standard.

23. The method of Claim 17 further comprising generating a look-up table with different sizes of scatterers.

10 24. The method of Claim 17 further comprising correcting the fluorescence spectrum to obtain an intrinsic fluorescence spectrum.

25. The method of Claim 17 further comprising transforming the light scattering spectrum and removing spectral components to determine size distribution of a tissue component.

15 26. The method of Claim 17 further comprising performing discriminant analysis for providing a real-time diagnosis for the tissue.

20 27. The method of Claim 17 further comprising separating a plurality of scattering coefficient values into a plurality of different regions.

28. An apparatus for optically measuring a structure in a layer of tissue comprising:
25 a radiation source that illuminates a region of interest in tissue to be measured with incident radiation;
an optical system that collects scattered, fluorescent and reflected light from the tissue at a plurality of wavelengths;

a detector system that senses the collected light and provides a fluorescence spectrum, a reflectance spectrum and a scattered spectrum as a function of wavelength; and

5 a data processor that determines a characteristic of a region of interest with the fluorescence spectrum, the reflectance spectrum and the scattered spectrum.

29. The apparatus of Claim 28 further comprising a broadband light source that generates light in the range of 330-700 nm.

10 30. The apparatus of Claim 28 further comprising a fiber optic probe that couples the source to the tissue.

15 31. The apparatus of Claim 28 wherein the probe is insertable in an endoscope.

32. The apparatus of Claim 28 further comprising a fast excitation-emission matrix instrument.

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